

WHAT IS CLAIMED IS:

1. A lead-free piezoelectric ceramic composition wherein Cu is contained in a perovskite compound of a non-stoichiometric composition represented by a formula $(K_xA_{1-x})_y(Nb_{1-z}B_z)O_3$, wherein "A" represents at least one of Na and Bi, while "B" represents at least one of Ta and Ti, and wherein $0 < x \leq 1$, $0 < y < 1$, and $0 \leq z \leq 1$.

2. The lead-free piezoelectric ceramic composition according to claim 1, wherein 0.2-1.0 at.% of Cu is contained in the whole amount of said perovskite compound.

3. The lead-free piezoelectric ceramic composition according to claim 2, wherein at least 0.4 at.% of Cu is contained in the whole amount of said perovskite compound.

4. The lead-free piezoelectric ceramic composition according to claim 2, wherein no more than 0.8 at.% of Cu is contained in the whole amount of said perovskite compound.

5. The lead-free piezoelectric ceramic composition according to claim 1, wherein a value "y" in said formula is at least 0.9.

6. The lead-free piezoelectric ceramic composition according to claim 5, wherein said value "y" is less than 0.99.

7. The lead-free piezoelectric ceramic composition according to claim 1, wherein at least 0.2 at.% of Cu is contained in the whole amount of said perovskite compound, and a value “y” in said formula of said perovskite compound is less than 0.99.

8. The lead-free piezoelectric ceramic composition according to claim 1, wherein a value “z” in said formula of said perovskite compound is no more than 0.4.

9. The lead-free piezoelectric ceramic composition according to claim 1, wherein Cu is contained in said perovskite compound, in the form of at least one of compounds $K_aCu_bNb_cO_d$, $K_eCu_fTa_gO_h$ and $K_iCu_jTi_kO_l$, wherein “a” through “l” are arbitrary numerical values.

10. The lead-free piezoelectric ceramic composition according to claim 1, wherein a value “x” in said formula of said perovskite compound is equal to 0.5.

11. A process of preparing a lead-free piezoelectric ceramic composition, comprising the steps of:

preparing a starting composition including, as a primary component, a perovskite compound represented by a formula $(K_xA_{1-x})(Nb_{1-z}B_z)O_3$, wherein “A” represents at least one of Na and Bi, while “B” represents at least one of Ta and Ti, and wherein $0 < x \leq 1$, and $0 \leq z \leq 1$, and as a secondary component, at least one of compounds $K_aCu_bNb_cO_d$, $K_eCu_fTa_gO_h$ and $K_iCu_jTi_kO_l$, wherein

“a” through “l” are arbitrary numerical values; and
subjecting said starting composition to a firing treatment.

12. The process according to claim 11, wherein said step of preparing a starting composition comprises preparing a mixture consisting of (a) a first starting material as said primary component in the form of a perovskite compound of a non-stoichiometric composition represented by a formula $(K_xA_{1-x})_y(Nb_{1-z}B_z)O_3$, wherein $0 < y < 1$, and (b) a second starting material as said secondary component serving as a source of Cu, and said step of subjecting said starting composition comprises calcining said mixture.

13. The process according to claim 12, wherein said second starting material is CuO.

14. The process according to claim 11, wherein said secondary component includes one of $K_4CuNb_8O_{23}$ and $K_5Cu_2Nb_{11}O_{30}$.